Remarks

For the reasons set forth below, reconsideration and withdrawal of all rejections set forth in the Office Action mailed December 12, 2008 are respectfully requested.

Rejections Under 35 U.S.C. §112 second Paragraph

Claim 43 has been amended to overcome the rejection of paragraph 7 of the Office Action. The term "rocker" has been replaced by a recitation that said lifting device "moves said revolving disc diaphragm in a rocking steering movement." Support may be found for example in Figs. 9 and 10a and the descriptions thereof from the second full paragraph on page 13 through the end of the second full paragraph on page 13 of the Specification. Note specific support for the term "steering movement" at line 4 of page 14 and the indication of same by arrow 32 in Fig. 10a.

The rejection of paragraph 8 of the Office Action has been overcome by amending claim 50 to delete the acronym EUVL in favor of reference to "a beam of extreme ultra-violet light." A person of ordinary skill in the art of optical imaging devices for semiconductor microlithography would immediately understand the acronym EUVL to stand for "extreme ultra-violet lithography and that such refers to using a beam of extreme ultra-violet light."

In view of the foregoing amendments, the rejections of claims 43 and 50 under 35 U.S.C. §112 second paragraph are respectfully submitted to be overcome.

New Claims 52 and 53

No rejections based on prior art were made concerning claims 43 and 50 in their original form. New independent claims 53 and 54 presented herein are drawn to the

subject matter of original claims 43 and 50, respectively but have been drafted to avoid the 35 U.S.C. §112 second paragraph issues noted by the Examiner in paragraphs 7 and 8 of the Office Action. Claims 53 incorporates all the elements of original claim 43 and its original intervening claims 33 and 27 and its base claim, original claim 26. New independent claim 53 incorporates all of the elements of original claim 50 and its base claim, original claim 26. Accordingly, new claims 52 and 53 are respectfully submitted to be in condition for allowance in their present form.

Rejections Under 35 U.S.C. §102(b) and 103

Schuster et al. '510 is the only prior art relied upon in support of all outstanding rejections under 35 U.S.C. §102(b) (Claims 26-31, 34, 36, 40, 41 and 49) and those under 35 U.S.C. §103 (claims 32 and 42). For at least the reasons which will now be discussed, Applicant respectfully requests those rejections be reconsidered and withdrawn.

Schuster et al. '510 is directed to an optical imaging device with at least one system diaphragm (1) which is adjustable in its opening diameter in such a way that the opening diameter of the diaphragm opening and the position of the diaphragm opening with respect to the optical axis are adjustable in a mutually dependent manner. The system diaphragm (1) of Schuster et al. '510 includes two adjustable iris diaphragms 2a and 2b in the embodiment of Fig. 1 and one adjustable iris diaphragm 2 in the case of the embodiments of Figs. 2 and 3. As disclosed at column 3 lines 55-62 a further diaphragm, may be a fixed diaphragm in the form of a "permanently installed disk" may also be fitted at an axial distance from the two diaphragms 2a and 2b.

In the embodiment of Fig. 1 of Schuster et al. '510, the two iris diaphragms 2a and 2b each have a plurality of leaves 3 which move to provide adjustable opening

diameters Da and Db, respectively. Iris diaphragms 2a and 2b are positioned spaced apart from one another along the optical axis (4) and are oriented such that their respective diaphragm openings are perpendicular to the optical axis (4). Although the diaphragm openings of all of the diaphragms in the system diaphragm (1) remain centered on the optical axis, and thus, in the path of the operating light beam, only the diaphragm whose opening diameter is the smallest at a given time serves to define an optically active edge (10) which the outer limits of the bundle of rays making up the light beam at that given time. For example, when diaphragm opening Da is the smallest, diaphragm (2a) functions as the optical active diaphragm at the axial position of diaphragm (2a). Conversely, when diaphragm (2b) is adjusted so that its opening Db is smaller than either Da, or the diameter of any fixed opening diaphragm permanently installed at some other axial position, the optically active diaphragm will be diaphragm (2b). In that case, the optically active diaphragm will be located at the axial position corresponding to diaphragm (2b) or that of the permanently installed diaphragm as the case may be. Thus, the opening diameter and axial position of the optically active diaphragm element of the system diaphragm (1) of the embodiment of Fig. 1 of Schuster et al. '510 are dependent in a step-wise manner.

The embodiment of Fig. 2 of Schuster et al. '510 provides an arrangement in which a single iris diaphragm is continuously adjustable in both opening diameter and axial position. The leaves (3) of the iris diaphragm 2 are carried by a mechanism which allows the opening diameter and the axial position of the opening to be adjusted in fixed dependence on one another. In the embodiment of Fig. 3 of Schuster et al. '510, a prescribed dependence of opening diameter and axial position of the optically effective

edge of an iris diaphragm is achieved by a mechanism in which the adjustable leaves of an iris diaphragm are arranged at an acute angle to the optical axis.

Although as noted above, a fixed opening diaphragm may be included at some particular axial position, all of the embodiments disclosed in Schuster et al. '510 require use of at least one diaphragm, such as an iris diaphragm, whose diaphragm opening has peripheral edge which is physically adjustable to change size and/or shape in accordance with the relative positions of a plurality of leaves (3) or the like and which together serve to define an adjustable edge of the diaphragm opening. Even when any particular one(s) of the diaphragms of a device constructed according to Schuster et al. '510 are not "optically active," the diaphragm openings of all of the diaphragms 2, 2a, 2b are always in the beam and occupy space within the device even when they are not optically active. The bulk and mass associated with iris diaphragms is due not only to the plural individual blades or leaves which operate to form the variable-geometry diaphragm opening but, as is apparent from Schuster et al. '510, is further greatly increased by the associated mechanical members needed to drive those blades to change the size and/or shape of the diaphragm opening of the iris diaphragms.

As noted in Applicant's Specification in the second full paragraph on page 4, the installation space requirements associated with iris diaphragms are particularly problematic in EUVL optical imaging devices. Space within the housing which contains the optical elements arranged along the beam path is very limited in such devices. The mass and multiplicity of moving parts associated with iris diaphragms also makes them prone to vibration and a lack of overall rigidity. These tend to degrade the high precision

which is a core reason for carrying out semiconductor microlithography using light in the extreme ultra-violet range.

Claim 26 has been amended to even more clearly patentably distinguish over the prior art of record, including without limitation Schuster et al. '510. In addition to being amended to drop use of the acronym "EUVL" challenged by the Examiner in connection with original claim 50, claim 26 in its present form recites:

> *"a plurality of diaphragms each of which has a respective diaphragm opening of a fixed geometry, said fixed geometry of said diaphragm openings being different in different respective ones of said diaphragms and,*
>
> *a diaphragm device for storing said diaphragms in a diaphragm store and selectively exchanging diaphragms between said diaphragm store and an operating position, said diaphragm openings of said diaphragms present in said diaphragm store being located out of the beam path, the said diaphragm opening of a said diaphragm present in said operating position being located in the beam path, whereby the objective can be selectively stopped down according to the said fixed geometry of the said diaphragm opening of any one of said diaphragms from said diaphragm store which is selectively introduced into said operating position."*

These recitations clearly patentably distinguish over the prior art of record including without limitation Schuster et al. '510.

The device as now claimed in claim 26 includes a plurality of diaphragms with respective diaphragm openings of different fixed geometries and a diaphragm device for

storing those diaphragms in a diaphragm store such that their diaphragm openings are located out of the beam path when they are in storage, and selectively exchanging them between the diaphragm store and an operating position in which the fixed geometry diaphragm opening of one of the diaphragms is introduced into the beam path so the objective can be selectively stopped down according to the particular fixed size and/or shape of whichever one of the diaphragms is introduced into the operating position.

Unlike Schuster et al. '510, the invention as claimed in amended claim 26 allows a diaphragm opening of a fixed desired size and shape to be selectively introduced into the operating position without requiring the simultaneous presence in the beam path of the diaphragm opening of one or more other "optically inactive" diaphragms. Because the diaphragms are of the type having a diaphragm opening of a fixed geometry, the diaphragms do not require a plurality of movable blades to adjust the opening as in an iris diaphragm and do not require complex or bulky mechanisms connected to the blades to adjust them. Applicant's invention as claimed thus allows for a very compact diaphragm structure and one which is significantly less apt to transmit vibration to the optical elements in the beam path. This is particularly beneficial in EUVL systems since due to the extreme ultra-violet wavelengths used, available space in the vicinity of the path is limited and high imaging accuracy is desired.

There is no evidence of record in Schuster et al. '510 or otherwise that can reasonably be construed to support an assertion that it was known in the prior art, or that it would have been obvious to one of ordinary skill in the art at the time Applicant's invention was made to provide an optical imaging device for semiconductor microlithography using a beam of extreme ultra-violet light with a diaphragm device for

storing a plurality of diaphragms having respective diaphragm opening of different geometries in a store where the diaphragm openings are located out of the beam path and exchanging selected ones of those fixed geometry diaphragms between the store and an operating position in which the diaphragm opening of a diaphragm in the operating position is located in the beam path whereby the optical imaging device can be stopped down according to the fixed size and shape of whichever one of the diaphragms is selectively introduced into the operating position.

Claims 27, 28, 29, 30, 31, 32, 34, 36, 40, 41 and 42 each depend directly or indirectly from amended claim 26 and are therefore respectively smutted to be patentable for at least the reasons noted above as to claim 26 in its present form. Therefore, reconsideration and withdrawal of the rejections of those claims is respectfully submitted to be in order.

Claim 50, which is drawn to a diaphragm device, has been amended in conformity with the amendments which have just been discussed in regard to the optical imaging device of claim 26 and is therefore allowable for at least the same reasons as claim 26.

The pending claims have been amended in purely formal respects so that each claim begins with an article, namely the word "An" or, in the case of claim 5, the word "A," and so that the word "claim" is no longer capitalized.

Claim 27 has been amended to further clarify the relationship of the revolving disc diaphragms recited in claim 27 to the "plurality of diaphragms."

Claim 28 has been amended to identify the recited "opening" as being associated with a housing of the optical device. Support may be found for example in Fig. 8 and the description on page 12 of the Specification.

Claim 29 has been amended to provide antecedent basis for the term "separate plug-in units."

Claim 30 has been amended to recite a structural reference namely, "said opening in said housing," for the displaceability of the disc diaphragm stack. Support may be found for example in Fig. 8 and its associated description in the paragraph bridging pages 12 and 13 of the Specification.

Claim 31 has been amended to depend from claim 29 rather than from claim 27 to provide antecedent basis for the term "separate plug-in unit." Its language has been further clarified by eliminating use of "in particular also" in favor of more idiomatic language.

Claim 32 has been amended to use the term "comprises" instead of "is designed as."

Claim 36 has been amended to depend to provide clear antecedent basis for the term "lifting device."

Claim 40 has been amended to associate the recited "opening" with a housing. Support may be found for example in Fig. 8 and in the last paragraph of page 12 of the Specification.

Claim 42 has been amended to provide clear antecedent basis for the "lifting device" recitation.

Conclusion

In view of the foregoing it is believed that all the objections and rejections of record have been overcome and that all pending claims are patentable over the prior art of record and are in condition for allowance in their present form.

Respectfully submitted,

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